

## THE INFLUENCE OF TREATMENT WITH CORTICO-BASAL IMPLANTS UNDER IMMEDIATE PLACEMENT IMMEDIATE LOADING (IPIL) PROTOCOLS ON PATIENTS' ORAL HEALTH-RELATED QUALITY OF LIFE. A PROSPECTIVE STUDY

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Received date: 15 March 2021

Revised date: 05 April 2021

Accepted date: 25 April 2021

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### ABSTRACT

**Background:** Research on immediate loading oral implantology has focused on the survival of conventional dental implants with a limited number of studies investigating cortico-basal implants. **Objective:** To examine the impact on oral health-related quality of life (OHQoL) in patients treated with IPIL cortico-basal implants in relation to demographic and clinical factors. **Materials and methods:** 98 patients aged 20-79, 51% female, with different oral pathologies, treated with IPIL cortico-basal implants completed pre-operative (preopOHIP-17) and post-operative (postopOHIP-18) questionnaires. **Results:** The results showed a significant improvement in patients' overall well-being, articulation, and speech ability, and a significant reduction in functional, psychological, and social problems ( $p < 0.001$ ) irrespective of demographic and clinical characteristics. Chewing ability improved in 91% of the patients, articulation and psychological state in 89% and 86%, respectively. Patients with treatment of both mandible and maxillae obtained significantly higher satisfaction versus those with treatment in one complete/partial jaw ( $p = 0.038$ ) and a greater improvement in mastication ( $p = 0.027$ ) and psychological state ( $p = 0.018$ ). Problems were minimal and subsided after the 12<sup>th</sup> post-operative month. **Conclusions:** Our data show that IPIL cortico-basal implants are an effective method for restoring the oral health and quality of life of completely and partially edentulous patient. The higher satisfaction level of patients requiring and receiving complex treatment of both jaws should be taken under consideration as an argument when choosing between a full restoration supported only by implants or using remaining natural teeth.

**KEYWORDS:** oral health-related quality of life, patient centered outcomes, cortico-basal implants, immediate placement immediate loading protocols.

### INTRODUCTION

In a healthy stomatognathic system usually a bilateral chewing pattern is present. Deviations from the physiological bilateral chewing pattern towards pathological unilateral or anterior chewing patterns are associated/caused with tooth loss caused by periodontal disease, complications of decay, trauma, neoplasms, and other factors such as the development of an Angle Class 2 skeletal situation.<sup>[1,2]</sup> The latter developments/adaptations have a direct impact on patients' chewing ability, articulation and speaking, aesthetics, psychological state, and social well-being. Anterior patterns of chewing also develop after loss of molars and premolars.

The treatment with immediately loaded basal implants has proven to be a reliable, esthetic, and successful

method.<sup>[3]</sup> It can be used for single-tooth restorations and for restoring bilateral balanced function of the stomatognathic system in completely and/or partially edentulous patients. It has demonstrated a success rate of up to 98%<sup>[4]</sup> irrespective of the pretreatment clinical and demographic conditions, such as advanced periodontitis<sup>[5]</sup> advanced bone atrophy, age, sex, smoking, and diabetes<sup>[6]</sup> Research on immediate loading oral implantology has mostly focused on the efficacy of conventional dental implants<sup>[7,8]</sup> with a limited number of studies about IPIL cortico-basal implants.<sup>[9]</sup>

Cortico-basal screw implants belong to the group of basal implants and show 'dual integration' into the bone, allowing masticatory loads to be transmitted reliably into the second and/or third cortical, already before 'biologic osseointegration' around the implants takes place.<sup>[10-16]</sup>

The aim of the treatment with cortico-basal implants is immediate (within 72 hours) restoration of the bilateral mechanically stable balanced function of the stomatognathic system based on the concept of lingualized occlusion.<sup>[17]</sup> The treatment consists of two main phases: surgical and prosthetic.

The surgical phase involves the placement of the implants under immediate placement immediate loading protocols according to 16 recognized and clinically proven methods for placing the cortico-basal implants.<sup>[18]</sup> The prosthetic phase includes restoring bilaterally balanced lingualized occlusion in Jaw Centric (Centric Relation) through the fabrication of fixed prosthesis; in case of severe ridge resorption, monoplane occlusion is used.<sup>[19,20,21]</sup>

The present study aimed to examine the effect of the treatment with IPIL cortico-basal implants on patients' oral health-related quality of life with a focus on articulation and speaking ability, physiological comfort, masticatory function, psychological state, and social well-being. The role of demographic and clinical variables (age, gender, complexity of the treatment, masticatory function, periodontal disease, smoking, and diabetes) was also investigated.

## MATERIALS AND METHODS

Ninety-eight patients included in this study were treated following the protocol described above. Up to 72 hours after the insertion of the implants, MFC (metal fused ceramic) restorations were fabricated and permanently

cemented for all the patients. The distal occlusal contacts were created on two premolars and the mesial part of the first molar (**Fig.1**).



**Fig. 1: Palatalized occlusion. The masticatory contacts are located only on the palatal cusps of the maxillary teeth in order to decrease the size of the supporting polygon.**

In full jaw restorations the anterior teeth were strictly kept out of contact. The incisor inter-arch relation was 2mm overjet and 0.5 to 0.00mm overbite (**Fig. 2 and 3**). The rationale for avoiding front contacts is to reduce the masticatory load [22], prevent occurrence of the anterior chewing pattern, off-axis loading of the frontal group of the implants in the maxilla [23], and reduction of the extrusive forces on the distal groups of the implants. In partial jaw restorations (segment cases) where the natural teeth were present at the front, the pre-treatment incisal inter-arch relation was retained.



**Fig. 2: Zero to 0.5 mm overbite.**



**Fig. 3: 2mm overjet.**

## The study

The study used data from a cohort of patients treated with cortico-basal implants under IPIL protocols at a Cortico-basal Private Implant Center, in Sofia, Bulgaria, in the period between 2017 and 2020. The patients filled in a pre-operative and a post-operative OHQoL questionnaire the latter being given during a control examination at least three months after the treatment to allow the patient time to adapt to the new situation.<sup>[24]</sup> To avoid bias, all patients coming for regular checkups were given the OHRQoL questionnaire on arrival, before the appointment so as not to be influenced by the treatment provider. The data collection was performed in compliance with the ethical principles specified in the

World Medical Association Declaration of Helsinki, revised in 2000, Edinburgh. To safeguard the patients' rights and unbiased treatment, informed consent was obtained by a well-informed dental assistant who was not engaged in the investigation.

A total of 98 patients, aged from 20 to 79, met the following inclusion criteria: 1) completed the questionnaire before and after the treatment; 2) provided written consent for their data to be used for research purposes with the understanding that all personal information would be kept confidential and with no consequence for their treatment and subsequent monitoring; 3) to have no missing data or on no more

than two missed questions. Excluded from the study were patients who: 1) completed only the “before treatment” or “after treatment” version of the questionnaire; 2) did not answer more than 2 questions; 3) did not provide written consent for their data to be used for the purposes of scientific research.

#### Data collection questionnaire Oral Health Impact Profile OHIP-20

The reduced version of OHIP adapted for edentulous patients, the OHIP-EDENT consisting of 20 questions, was used. OHIP-20 has been proven to be a reliable instrument for the assessment of the health-related quality of life among both the general population and edentulous patients.<sup>[25]</sup> It has also been established that the shortened version of the OHIP has measurement properties comparable with the full 49-item version.<sup>[26]</sup>

A modified version of the *OHIP-20 for Dental Implants Patients* was used to assess the patients' quality of life before and after the treatment with immediate loading cortico-basal dental implants. The questionnaire was translated into Bulgarian by a specialist with clinical experience and reviewed by another bilingual clinician. It was pilot-tested with 10 other patients, and subsequent changes and edits were made. Two questions were excluded from the questionnaire as they were difficult to understand without external help. The Cronbach's alpha test based on 198 questionnaires, not included in the present data, showed an internal consistency  $\alpha = 0.858$ , standardized  $\alpha = 0.858$ .

The questionnaire included a background section about patients' age group; sex; time of completing the questionnaire, classification of the treated region. The questions covered conceptual domains such as functional limitations, physiological difficulties, psychological discomfort, and social handicap. The satisfaction questions were measured on a scale of 1 to 5, with increasing numbers marking higher levels of satisfaction. The oral health issues were assessed on an ordinal scale (1 = never; 2 = seldom; 3 = sometimes; 4 = frequently; 5 = always).

The patients were further allocated into clinically relevant subgroups, based on factors with a scientifically

proven impact on OHRQoL: masticatory function,<sup>[27,28]</sup> bilateral chewing pattern, unilateral chewing pattern, anterior chewing pattern, chewing on dentures; reason for tooth loss,<sup>[29,30]</sup> advanced periodontitis, decay complications; main occluding areas,<sup>[31]</sup> absence, unilateral presence, bilateral presence, presence on dentures); smokers (yes-no); diabetes (yes-no).

#### Statistical analysis

The data analysis was performed with the statistical software IBM SPSS version 27 (2020) and Minitab version 19 (2019) [32, 33]. The data concerning the patients' level of satisfaction were described through the means, standard deviations (SD), medians, minimum and maximum values. The frequency data were presented with the corresponding numbers and percentages. The main statistical analysis involved the Wilcoxon-signed rank test for testing the null hypothesis that the average signed-rank of participants' answers before and after data was zero. To examine the impact of demographic and clinical factors on the patients' quality of life, we used the Mann-Whitney U test for factors with two categories and the Kruskal-Wallis non-parametric ANOVA for more than two categories. The individual and mean changes in the frequency of oral health problems were calculated, and the relationship with demographic and clinical factors was examined through independent-samples t-tests and one-way analysis of variance (ANOVA). The Chi-square test and Fisher's exact test were used for categorical data. All statistical tests were two-tailed and interpreted as significant (\*) at  $p < 0.05$ , very significant (\*\*) at  $p < 0.01$ ; and highly significant (\*\*\*) at  $p < 0.001$ .

## RESULTS

#### Patients' background information

The patients' background information (Table 1) showed similar proportions of men (49%) and women (51%), with 70% of them being younger than 60 years. The time of completing the *after* questionnaire varied from 3 to 24 months, mean  $8.83 \pm 4.05$  months, median 7 months. The patients with both edentulous jaws comprised 72.40%; with unilateral chewing pattern 40.80%; with periodontitis 64.30%; with absence of occluding areas 43%; smokers 57% and with diabetes 7.10%.

**Table 1: Patients' background information.**

Variables	N (%)
<b>Sex</b>	
○ Men	48 (49.00%)
○ Women	50 (51.00%)
<b>Age</b>	
○ < 60 years	69 (70.00%)
○ > 60 years	29 (30.00%)
<b>After-questionnaire time</b>	
○ 3 to 6 months	34 (35.00%)
○ 7 to 12 months	51 (52.00%)
○ 13 to 24 months	13 (13.00%)

<b>Complexity of the treatment</b>	
○ Both upper and lower complete edentulous jaws	71 (72.40%)
○ One complete and/or partially edentulous jaw	27 (27.60%)
<b>Masticatory function</b>	
○ Bilateral chewing pattern	22 (22.40%)
○ Unilateral chewing pattern	40(40.80%)
○ Anterior chewing pattern	23 (23.50%)
○ Chewing on dentures	13 (13.30%)
<b>Reason for tooth loss/extraction</b>	
○ Advanced periodontitis	63 (64.30%)
○ Decay complications	35 (33.70%)
<b>Main occluding areas</b>	
○ Absence	42 (43.00%)
○ Unilateral presence	25 (25.50%)
○ Bilateral presence	15 (15.30%)
○ Presence on dentures	16 (16.20%)
<b>Smoking</b>	
○ Yes	57 (58.20%)
○ No	41 (41.80%)
<b>Diabetes</b>	
○ Yes	7 (7.10%)
○ No	91 (92.90%)

#### Patients' overall satisfaction with the outcome of the treatment with IPIL cortico-basal implants

The patients reported a high level of satisfaction with the IPILcortico-basal implants: mean satisfaction level  $4.93 \pm 0.24$ , median 5, minimum 4, and maximum 5 (Table 2). The patients with two complete edentulous

jaws showed a higher level of satisfaction as compared to those with one complete and/or partially edentulous jaw,  $p = 0.029$ . The rest of the demographic and clinical factors did not have a significant effect on the patients' contentment with the treatment with IPIL cortico-basal implants ( $p > 0.05$  for all statistical tests).

**Table 2: Patients' overall level of satisfaction with the outcome of the treatment with cortico-basal implants under IPIL protocols in relation to demographic and clinical variables.**

Variables	Mean $\pm$ SD	Median	Min.-Max.	p
<b>Total</b>	4.93 $\pm$ 0.24	5	4 - 5	na
<b>Gender</b>				
○ Men	4.95 $\pm$ 0.20	5	4 - 5	0.447 <sup>U</sup>
○ Women	4.92 $\pm$ 0.27	5	4 - 5	
<b>Age</b>				
○ < 60 years	4.97 $\pm$ 0.17	5	4 - 5	0.117 <sup>U</sup>
○ $\geq$ 60 years	4.85 $\pm$ 0.35	5	4 - 5	
<b>After-questionnaire time</b>				
○ 3 to 6 months	4.90 $\pm$ 0.29	5	4 - 5	0.514 <sup>KW</sup>
○ 7 to 12 months	4.94 $\pm$ 0.23	5	4 - 5	
○ 13 to 24 months	5.00 $\pm$ 0.00	5	5 - 5	
<b>Complexity of the treatment</b>				
○ Both upper and lower complete edentulous jaws	4.97 $\pm$ 0.16	5	4 - 5	0.029 <sup>U*</sup>
○ One complete and/or partially edentulous jaw	4.85 $\pm$ 0.36	5	4 - 5	
<b>Masticatory function</b>				
○ Bilateralchewingpattern	4.90 $\pm$ 0.29	5	4 - 5	0.288 <sup>KW</sup>
○ Unilateral chewing pattern	4.94 $\pm$ 0.22	5	4 - 5	
○ Anteriorchewingpattern	5.00 $\pm$ 0.00	5	5 - 5	
○ Chewing on dentures	4.84 $\pm$ 0.37	5	4 - 5	
<b>Reason for tooth loss/extraction</b>				
○ Advanced periodontitis	4.90 $\pm$ 0.29	5	4 - 5	0.073 <sup>U</sup>
○ Decay complications	5.00 $\pm$ 0.00	5	5 - 5	
<b>Main occluding areas</b>				
○ Absence	4.97 $\pm$ 0.15	5	4 - 5	
○ Unilateral presence	4.95 $\pm$ 0.20	5	4 - 5	

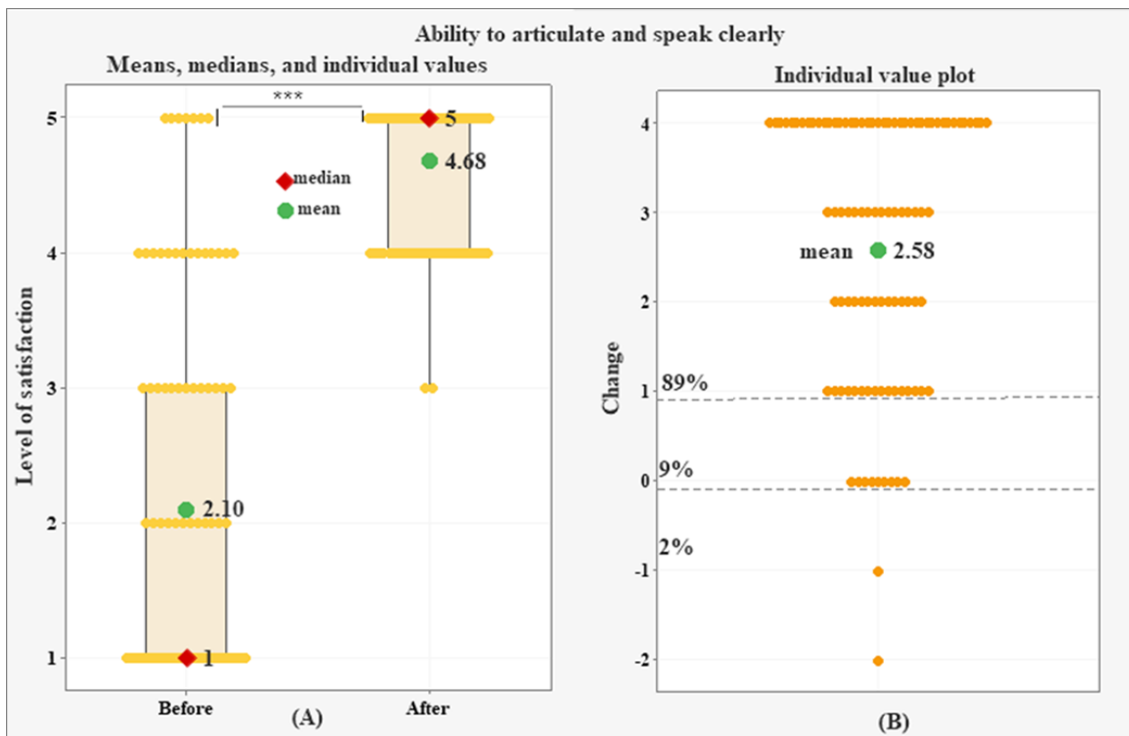
○ Bilateral presence	4.84±0.30	5	4 - 5	0.253 <sup>KW</sup>
○ Presence on dentures	4.87±0.34	5	4 - 5	
<b>Smoking</b>				
○ Yes	4.96±0.18	5	4 - 5	0.194 <sup>U</sup>
○ No	4.90±0.30	5	4 - 5	
<b>Diabetes</b>				
○ Yes	5.00±0.00	5	5 - 5	0.483 <sup>U</sup>
○ No	4.93±0.25	5	4 - 5	

na- not applicable; U- Mann-Whitney U test; KW –Kruskal-Wallis non-parametric one-way ANOVA; \* - significant at  $p < 0.05$

**Ability to articulate and speak clearly before and after the treatment**

The patients’ satisfaction with their ability to articulate and speak clearly before and after the treatment revealed a highly significant improvement,  $p < 0.001$  (Fig. 3). The mean satisfaction level increased from  $2.10 \pm 1.37$  before the treatment to  $4.68 \pm 0.51$  after the treatment, with a mean difference of  $2.58 \pm 1.51$  (95% CI of the diff.: 2.27 to 2.88). The median level of satisfaction changed from 1 before the treatment to 5 after the treatment (A). The individual change showed that 89% (N=88) of the patients experienced an improvement in satisfaction by 1

to 4 levels; 9% (N = 9) did not have a change in their satisfaction level, and 2% (N = 2) reported a decrease in satisfaction by 1 and 2 levels. Of the nine participants with no change, five had marked a satisfaction level 5 and four a satisfaction level 4 before the treatment. The change in the patients’ ability to articulate and speak clearly was not significantly associated with their sex, age group, the reason for tooth loss, the complexity of the treatment, masticatory function, main occluding areas, smoking, and diabetes ( $p > 0.05$  for all statistical tests).



**Figure 3: Ability to articulate and speak clearly before and after the treatment. A significant improvement ( $p < 0.001$ ) after the treatment is illustrated on panel A. The individual changes in satisfaction show improvement by 1 to 4 levels in 89% of the patients; no change in 9% and decrease by 1/2 levels in 2% of the patients (panel B).**

**Change in the frequency of oral health problems**

The occurrence of oral health problems (Table 3) showed a significant reduction in frequency after the treatment with IPIL cortico-basal implants. Pain, swelling, and infections were reduced in frequency in 83% of the patients, were more frequent in 3%, and did not change in 14% ( $p < 0.001$ ). The percentage of patients with no pain increased to 87% from 2% before the

treatment. The patients who did not report a change never or rarely had pain, swellings, or infections before the treatment. Pain in the area in front of the ears, joints, and masticatory muscles was not a frequent problem in the majority of the patients before the treatment. Nevertheless, its frequency was significantly reduced after the treatment ( $p = 0.001$ ).

The greatest improvements were observed in relation to mastication and taste ( $p < 0.001$  for all comparisons in this domain). Chewing difficulties disappeared or became rare in 91% of the patients; 75% experienced a reduced need to interrupt meals, resulting in 96% of the patients never having to interrupt their meals due to chewing problems. Likewise, 81% of the patients reported a decreasing need to choose foods according to their chewing ability, 14% had no change, and 4% reported an increased need.

Before the treatment, 32% of the patients did not have problems related to taste and smell. Their percentage increased to 88% after the treatment; 11% reported rare problems, and 1% occasional. Overall, 65% of the patients experienced an improvement, 30% had no change, and 5% reported a more frequent impact on taste. The majority of the patients (45/64) who reported improved taste and smell had undergone treatment of both jaws or full upper jaw (8/64).

Reduced interaction with family and other people was not a frequent problem for the majority of the patients

before the treatment. Nevertheless, after the treatment, all 98 patients reported never having this problem, with an improvement for 26% of them and no change for 74% ( $p < 0.001$ ). In the social and psychological domain, the greatest improvement was observed in reducing stress and nervousness related to oral health problems. Before the treatment, the majority of the patients reported constant to occasional nervousness and stress, and only 10% did not experience such problems. After the treatment, 92% of the patients were entirely free of the problem, and 8% only rarely felt it. A positive change from the before treatment state was reported by 86% of the patients, and no change by 14%. None of the patients reported a negative impact ( $p < 0.001$ ). Before the treatment, 39% of the patients had occasional to frequent sleeping problems related to their oral health, and 61% did not have or have rare difficulties. After the treatment, sleeping difficulties related to oral health disappeared in 97% of the patients. As a whole, the quality of sleep improved for 69% of the patients, did not change for 30%, and was negatively affected for 1% ( $p < 0.001$ ).

**Table 3: Paired comparisons of patients' responses before and after the treatment with cortico-basal implants under IPIL protocols.**

Oral health issues	Time	Frequency N (%)					Wilcoxon	
		never	seldom	sometimes	frequently	always	% change	p
<b>PAIN &amp; INFECTION</b>								
Pain swelling infections	Before	2 (2%)	17 (17%)	36 (37%)	31 (32%)	12 (12%)	- 83% = 14% + 3%	<0.001
	After	85 (87%)	7 (7%)	6 (6%)	0 (0%)	0 (0%)		
Pain in front of ears/in joints	Before	68 (69%)	19 (20%)	8 (8%)	2 (2%)	1 (1%)	- 28% = 64% + 8%	0.001
	After	88 (90%)	9 (9%)	1 (1%)	0 (0%)	0 (0%)		
Pain in masticatory muscles	Before	58 (59%)	29 (30%)	9 (9%)	2 (2%)	0 (0%)	- 38% = 54% + 8%	<0.001
	After	86 (88%)	11 (11%)	1 (1%)	0 (0%)	0 (0%)		
<b>MASTICATION &amp; TASTE</b>								
Difficulties chewing	Before	3 (3%)	10 (10%)	20 (20%)	39 (40%)	26 (27%)	- 91% = 7% + 2%	<0.001
	After	60 (61%)	28 (29%)	10 (10%)	0 (0%)	0 (0%)		
Interrupting meal due to problems	Before	23 (23.50%)	26 (26.50%)	30 (31%)	14 (14%)	5 (5%)	- 75% = 24% + 1%	<0.001
	After	94 (96%)	4 (4%)	0 (0%)	0 (0%)	0 (0%)		
Choose food according to chewing	Before	11 (11%)	14 (14%)	21 (22%)	28 (29%)	24 (24%)	- 81% = 15% + 4%	<0.001

ability	After	67 (68%)	21 (22%)	6 (6%)	1 (1%)	3 (3%)		
Negative influence on taste and/or smell	Before	31 (32%)	22 (22%)	23 (24%)	13 (13%)	9 (9%)	- 65% = 30% + 5%	<0.001
	After	84 (86%)	10 (10%)	3 (3%)	1 (1%)	0 (0%)		
<b>SOCIAL &amp; PSYCHOLOGICAL DIFFICULTIES</b>								
Reduced interaction	Before	72 (74%)	10 (10%)	6 (6%)	6 (6%)	4 (4%)	- 26% =74% + 0%	<0.001
	After	98 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)		
Nervousness and stress	Before	10 (10%)	20 (20%)	32 (32%)	24 (24%)	14 (14%)	- 86% = 14% + 0%	<0.001
	After	90 (92%)	8 (8%)	0 (0%)	0 (0%)	0 (0%)		
Difficulty sleeping	Before	30 (31%)	29 (30%)	26 (26%)	10 (10%)	3 (3%)	- 69% = 30% + 1%	<0.001
	After	95 (97%)	2 (2%)	1 (1%)	0 (0%)	0 (0%)		

- :less frequent/improved; = :no change/sustained; +: more frequent

The individual changes in the frequency of oral health problems showed a significant relationship with the complexity of the treatment (Fig. 4). The patients who had undergone full treatment of both jaws showed a significantly higher mean reduction in chewing problems

(-2.40±1.26) as compared to those patients who had treatment in one complete and/or partial jaw (-1.76±1.20), p = 0.027. They also showed a significantly higher reduction in nervousness and stress (-1.94±1.10 versus -1.32±1.10, p = 0.018).

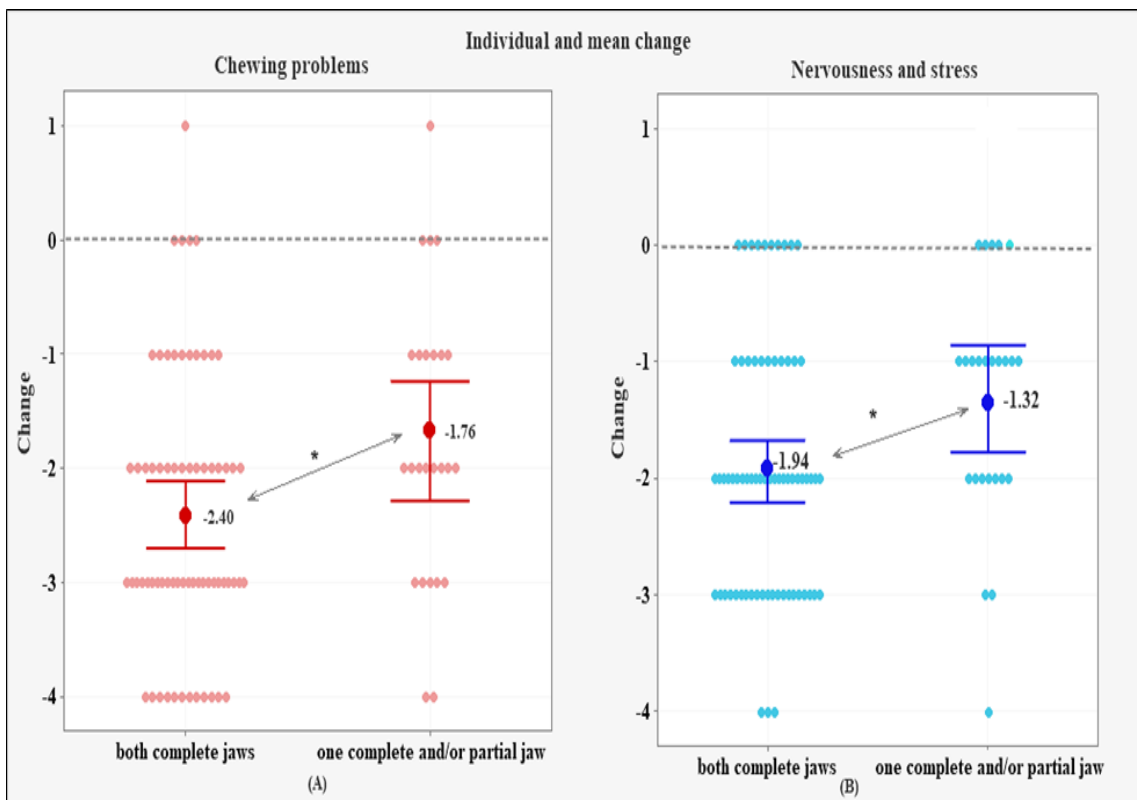


Figure 4: Individual and mean change in chewing problems (A) and nervousness and stress (B), showing a higher reduction in frequency in the group with full treatment of both jaws.

The patients in the younger age group (< 60 years) had a significantly higher mean reduction in nervousness and stress (-1.95±1.16) versus the patients in the older age group > 60 years (-1.42±0.95), p = 0.039. The patients

with diabetes showed a significantly higher reduction in chewing problems (-3.14±0.89) as compared to the patients without diabetes (-2.15±1.24), p = 0.043 (Fig. 5).

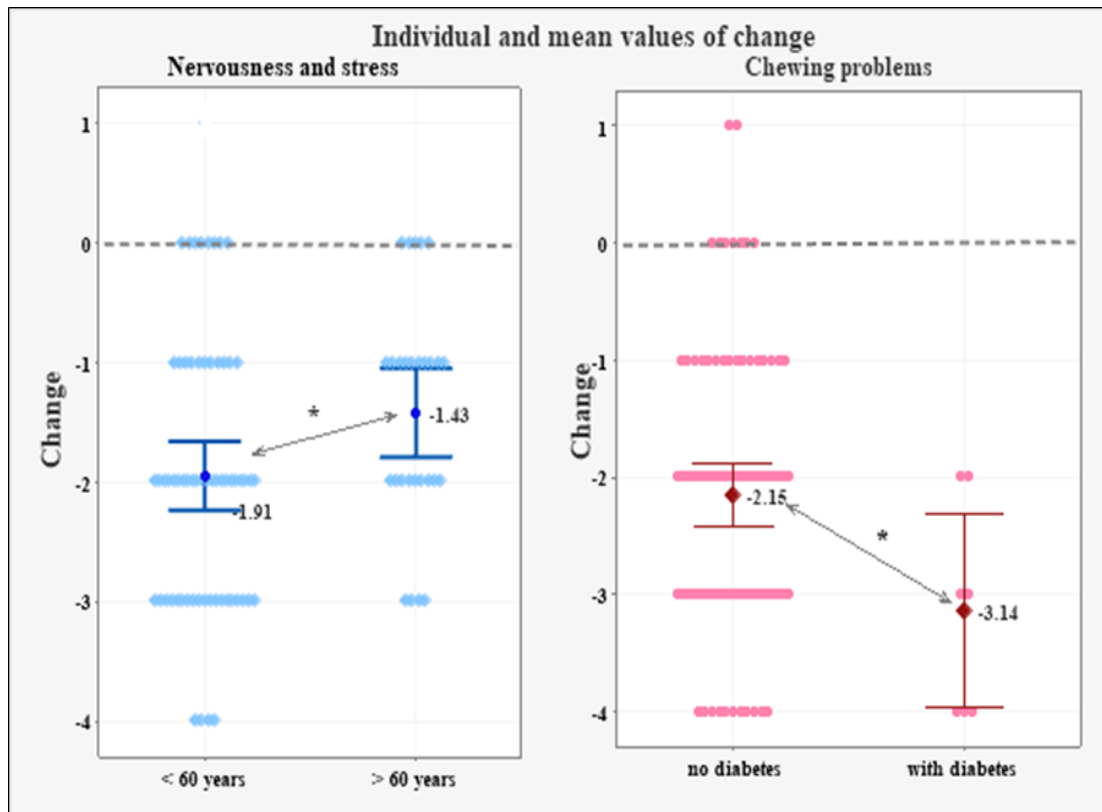


Figure 5: A significantly higher reduction in nervousness and stress in age group < 60 years (A). A significantly higher reduction in chewing problems in the patients with diabetes (B).

**Reported problems after treatment with IPIL cortico-basal implants**

Twenty patients (20%) reported problems after the treatment, including occasional pain and discomfort; chewing difficulties and one related to esthetics. The highest rate of problems (45%) were reported from the 3<sup>rd</sup> to the 6<sup>th</sup> month after the treatment; 40% occurred after the 6<sup>th</sup> to the 12<sup>th</sup> month; and 15% in the period after

the 12<sup>th</sup> to the 24<sup>th</sup> month. The distribution of the patients who reported problems according to the demographic and clinical factors (Table 4) did not show a significant association with the patients' sex (p = 0.21), age group (p = 0.59), smoking (p = 0.07), diabetes (p = 0.62), complexity of the treatment (p = 0.08), reasons for tooth loss (p = 1.00), masticatory function (p = 0.265), and main occluding areas (p = 0.183).

Table 5: Reported problems after the treatment with IPIL cortico-basal implants according to demographic and clinical factors.

Factors	N (%) patients who reported problems with implants	p
<b>Gender</b>		
○ men	7 (15%)	0.21 <sup>f</sup>
○ women	13 (26%)	
<b>Age group</b>		
○ < 60 years	13 (19%)	0.59 <sup>f</sup>
○ > 60 years	7 (24%)	
<b>Smoking</b>		
○ smokers	8 (14%)	0.07 <sup>f</sup>
○ non-smokers	12 (29%)	
<b>Diabetes</b>		



o Yes	2(29%)	0.6 2 <sup>f</sup>
o No	18 (20%)	
<b>Complexity of treatment</b>		
o Upper and lower complete edentulous jaws	11(16%)	0.0 8 <sup>f</sup>
o One complete edentulous jaw	9 (33%)	
<b>Reason for tooth loss</b>		
o Advanced periodontitis	13 (21%)	1.0 0 <sup>f</sup>
o Decay complications	7 (21%)	
<b>Masticatory function</b>		
o Bilateralchewingpattern	4 (18%)	0.2 65 <sup>c</sup>
o Unilateral chewing pattern	8 (20%)	
o Anteriorchewingpattern	3 (3%)	
o Chewing on dentures	5 (38%)	
<b>Main occluding areas</b>		
o Absence	7 (17%)	0.1 83 <sup>c</sup>
o Unilateral presence	7 (28%)	
o Bilateral presence	1 (7%)	
o Presence on dentures	5 (31%)	

f- Fisher's exact test; c- Chi-square test

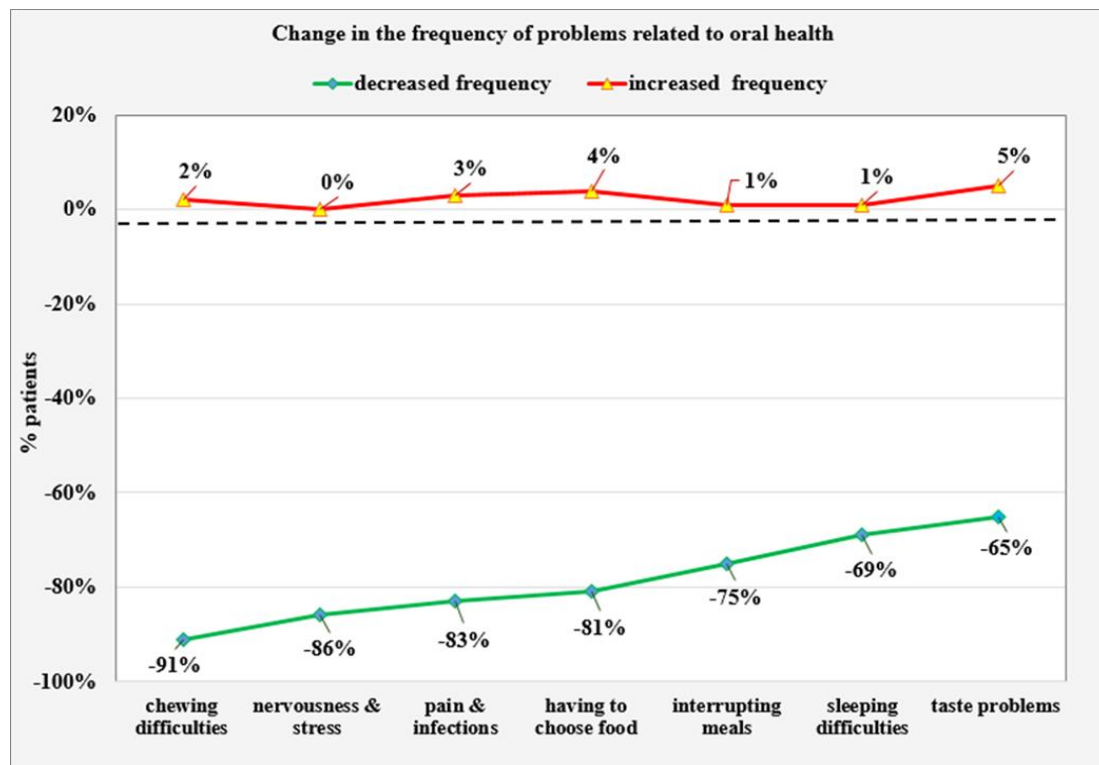
## DISCUSSION

Although several studies,<sup>[7,8,34]</sup> have reported on patients' satisfaction with endo-osseous implant-supported prostheses, studies about the effect of cortico-basal implants on OHRQoL are still rare. A positive impact of IPIL cortico-basal implants on patients' quality of life has been found by Awadalkreem et al.<sup>[9]</sup> Our results corroborate their findings and provide additional evidence about the effectiveness of the treatment with IPIL cortico-basal implants irrespective of the patients' sex, age, the reason for tooth loss, functional classification, occluding areas, smoking, and diabetes. The only exception was patients with full treatment of both jaws, who had a significantly higher satisfaction level as compared to those with treatment in one complete or partial jaw. The same patients also showed a significantly higher mean reduction in chewing problems, nervousness, and stress in comparison with the patients who had treatment in one complete and/or partial jaw. This finding can be explained by the fact that the more complex the treatment, the more freedom the treatment provider has to implement the surgical and the prosthetic protocols of cortico-basal implants to their full capacity. In turn, this allows for complete remediation of the pathology associated with the residual dentition.

The ability to speak is negatively affected by missing or loose teeth, especially in the frontal maxilla. Hence a number of studies have examined the impact on patients' articulation and speech in relation to treatments with conventional implants and reported improvements.<sup>[35,36]</sup> In the field of cortico-basal implantology, because of the special design of the occlusal scheme,<sup>[37,40]</sup> with no

occlusal contacts in the front, with 2mm overjet and zero overbite, it was important to investigate the impact of that given scheme on the patients' ability to articulate. Our results are reassuring as 89% of the patients experienced an improvement, and only 2% reported a decline in their articulation ability; the remaining 9% had no pre-operative speech-related problems, and their status remained unchanged.

A steady reduction in frequency to the full absence of oral-health problems was observed in the majority of the patients. (**Fig. 6**). Overall, the improvement in oral-health issues was not influenced by the demographic and clinical characteristics of the patients. The exceptions were the patients with a full treatment of both jaws (discussed earlier), the younger patients (< 60 years) who reported a significantly higher level of reduction in nervousness and stress and the patients with diabetes who had a significantly higher reduction in chewing problems.



**Figure 6: The most improved aspects of oral health as a result of the treatment with immediate loading dental implant.**

As a whole, our results indicate that IPIL cortico-basal implants are associated with minimal post-treatment problems in the first six to 12 months after the treatment, which subsided by the end of the 24<sup>th</sup> month. These findings are in agreement with previous reports, which have concluded that the patients' complaints decreased with time and completely disappeared after the 12<sup>th</sup> post-operative month.<sup>[7]</sup>

The main contribution of the present study is that it adds a new methodological aspect to the scientifically documented benefits of immediate loading dental implants for completely and/or partially edentulous patients by including IPIL cortico-basal implants in this domain of oral implantology research. We have examined how specific aspects of patients' oral health have been impacted in relation to demographic and clinical factors, some of which are novel for this research paradigm.

On the other hand, by categorizing the patients into different subsections, we have also imposed a limitation on the power of the statistical tests due to a reduced number of patients in certain subsections (e.g., diabetes). We recognize the need for follow-up research where certain target subsections of the study sample will be increased in size.

## CONCLUSIONS

Our results provide evidence that the treatment with IPIL cortico-basal implants is an effective method for restoring the bilateral balanced function of the

stomatognathic system in completely and/or partially edentulous patients, with a high rate of improvement in articulation and speaking ability, chewing ease, psychological and social well-being, and with a low rate of post-operative complaints which minimize by the 12<sup>th</sup> post-operative month. Extrapolating from the results, there is an indication that full restoration of both jaws may be preferred to leaving in a few natural teeth. The higher satisfaction level of the patients requiring and receiving complex treatment of both jaws should be taken under consideration as an argument when choosing between a full restoration supported only by implants or using remaining natural teeth.

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